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$$\sqrt{[1+(dy/dx)^2]} = \frac{1}{\sqrt{2}} [\sqrt{(y/x)} + \sqrt{(x/y)} (dy/dx)].$$

$$\text{Let } y=mx. \quad \therefore dy/dx = m + x(dm/dx) = m + px.$$

$$\therefore \sqrt{[1+(m+px)^2]} = \frac{1}{\sqrt{2m}} (2m+px). \quad \frac{x^2(1-2m)p^2}{2m} + 2x(1-m)p = (1-m)^2.$$

$$\therefore p = dm/dx = \frac{[1-m][1-\sqrt{(2m)}]\sqrt{(2m)}}{x[1-2m]} = \frac{\sqrt{[2m]}[1-m]}{x[1+\sqrt{(2m)}]}.$$

$$\therefore dx/x = \frac{[1+\sqrt{(2m)}] dm}{[1-m]\sqrt{[2m]}}.$$

$$\therefore \log[Cx(1-m)] = \frac{1}{\sqrt{2}} \log \left[\frac{1+\sqrt{m}}{1-\sqrt{m}} \right].$$

$$\log[C(x-y)] = \frac{1}{\sqrt{2}} \log \left[\frac{\sqrt{x}+\sqrt{y}}{\sqrt{x}-\sqrt{y}} \right] = \frac{1}{\sqrt{2}} \log \left[\frac{x+y+2\sqrt{xy}}{x-y} \right].$$

For the given point $x=a$, $y=b$.

$$\therefore C = \frac{[a+b+2\sqrt{(ab)}]^{1/\sqrt{2}}}{[a-b][a-b]^{1/\sqrt{2}}}.$$

$$\therefore \frac{[x+y+2\sqrt{(xy)}]^{1/\sqrt{2}}}{[x-y][x-y]^{1/\sqrt{2}}} = \frac{[a+b+2\sqrt{(ab)}]^{1/\sqrt{2}}}{[a-b][a-b]^{1/\sqrt{2}}}.$$

$$\therefore \frac{a-b}{x-y} = \left[\frac{[x-y][a+b+2\sqrt{(ab)}]}{[a-b][x+y+2\sqrt{(xy)}]} \right]^{1/\sqrt{2}}, \text{ or } [y-x]^{1/2} = c \frac{\sqrt{y}+\sqrt{x}}{\sqrt{y}-\sqrt{x}}.$$

139. Proposed by WM. FRED FLEMING, Chicago, Ill.

A tin watering-pot is constructed by joining the frustums of two right cones, so that their intersection is a mathematical one, their axes meeting at an angle of 45° . The bases of the smaller frustum are 2 inches and 4 inches in diameter, its altitude 8 inches. The bases of the larger frustum are 10 inches and 12 inches in diameter, its altitude 15 inches. In joining the two frustums the edges of the two larger bases are brought into coincidence. Water is poured into the vessel until it begins to run out of the spout. How many gallons (231 cubic inches) are required? How much water is in the spout and how much in the can? The vessel is tilted forward (in the plane of the axes of the two frustums) sufficiently to allow one-half of the water to run out. How much of the liquid is left in the spout and can, and what is the area of the surface of the water in spout and can? Through what angle has the vessel been tilted?

No solution of this problem has been received.